

**A NEW SPECIES OF *PSEUDOCENTROPTILOIDES*  
(EPHEMEROPTERA: BAETIDAE), WITH REVISIONS  
TO OTHER PREVIOUSLY UNNAMED BAETID  
SPECIES FROM TEXAS<sup>1,2</sup>**

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**ABSTRACT:** *Pseudocentroptiloides morihari*, new species, is described from larvae and male and female adults from Texas, USA. The species represents the second of the genus to be discovered in North America, where it is distinguished from *P. usa* primarily by size, labral and maxillary morphology, and ventral abdominal pattern in the larvae. *Pseudocentroptiloides morihari* was previously reported as *Centroptilum* sp. 2. Some other unnamed but numbered species of Baetidae reported from Texas are resolved to known nominal species of *Acerpenna*, *Baetis*, and *Centroptilum*, and the status of others is reviewed. Difficulty in separating adult males of *Pseudocentroptiloides* and some *Procloeon* is noted.

The small minnow mayfly genus *Pseudocentroptiloides* Jacob (Ephemeroptera: Baetidae) was revised by Waltz and McCafferty (1989) and has included *P. ceylonica* Glazaczow (Oriental), *P. christineae* Waltz and McCafferty (Oriental), *P. shadini* (Kazlauskas) (Palearctic; type species), and *P. usa* Waltz and McCafferty (Nearctic). Larvae are characterized by a V-shaped emargination on the labrum, broad maxillae, labial palp segments 3 that are greatly expanded and truncated, and glossae that are relatively short and truncate.

In 1977, one of us (WPM) collected very small and then unidentifiable larvae in Texas that were simply referred to as *Centroptilum* sp. 2, and subsequently reported as such by McCafferty and Davis (1992) and Lugo-Ortiz and McCafferty (1995). Recently, the other of us (NAW) collected additional larvae of this species in Texas and was able to rear adults. Close examination of the material in light of recent revisions of North American Baetidae (see e.g., McCafferty and Waltz 1990, Edmunds and Waltz 1996) shows that it is clearly *Pseudocentroptiloides* and that it represents a previously undescribed species. Prior to this discovery, *P. usa*, from the Midwest, was the only species of *Pseudocentroptiloides* known from the Western Hemisphere, and it and *P. shadini* were the only species known as adults. McCafferty and Waltz (1990) had predicted that additional species of *Pseudocentroptiloides* eventually would be found in North America. We are most honored to name this new species after Dennis Morihara (Pukalani, Hawaii), who helped collect the original material, and who contributed significant systematic work that catalyzed our modern understanding of the diverse and challenging family Baetidae in North America.

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Because of the state of knowledge at the time, a number of baetids collected from Texas could not be assuredly assigned to nominal species and thus were reported as numbered species by McCafferty and Davis (1992) and Lugo-Ortiz and McCafferty (1995). New analyses of much of that material, often in light of subsequent collections, have allowed us to update the identification status of those species. We provide this new information under the heading *Additional Species Revisions* following the new species description below.

***Pseudocentroptiloides morihari*, NEW SPECIES**

(Figs. 1-8)

*Centroptilum* sp. 2 McCafferty and Davis, 1992:207.

**Larva.** Lengths: body 4.0-5.5 mm; caudal filaments 1.6-2.0 mm. Head: Coloration pale, darkest around coronal and frontal sutures. Antennae broken but extending at least as far as fore coxae; scapes, pedicels, and flagella with sparse, fine, simple setae. Labrum (Fig. 1) sclerotized posterolaterally, slightly wider than long, and with broad triangular emargination apically; dorsal subapical setae present across entire width of labrum, relatively short and not extending beyond, or much beyond, distal margin of labrum. Mandibles (Figs. 2 and 3) with relatively broad bases. Maxillae (Fig. 4) with crest of fine setae extending basally well below galealacinia crown, setae longer or subequal to galealacinia denticles; digitate setae of galealacinia comb poorly developed (1-2 setae); palpi three segmented. Labium as in Fig. 5, with glossae nearly as wide as long and two-thirds to three-fourths length of paraglossae. Thorax: Notae cream, without distinct patterns. Hindwingpads present. Legs similar to Figs. 6 and 7 of Waltz and McCafferty (1989); claws subequal in length to respective tarsi. Abdomen: Coloration pale; terga light brown, darkest at anterior margins of each tergum. Sterna unicolorous cream, except for wide transverse brown band anteriorly on sternum 8 [mature individuals also with purplish transverse markings of adults (see below) on sterna 7 and 8]. Paraprocts with five to six marginal spines. Median caudal filament subequal in length to cerci.

**Male adult.** Lengths: body 4.6-5.8 mm; forewings 3.8-5.0 mm; hindwings 0.8-1.0 mm; cerci 8.0-10.0 mm. Head: Turbinate portion of compound eyes yellow, slightly divergent anteriorly, oval, ca. 1.6 times longer than wide in dorsal view, and on low stalks. Thorax: Coloration generally cream to light brown, sterna slightly paler than nota. Forewings (Fig. 6) with marginal intercalaries relatively long, especially posterior to MA<sub>2</sub> (longer than respective distal crossveins connecting longitudinal veins between MA<sub>2</sub> and ICuA<sub>1</sub>). Hindwings (Fig. 7) slightly broadened, with short marginal veins following 2nd main longitudinal vein. Abdomen: Segments 2-6 translucent white; segments 7-10 slightly darker; small longitudinal dashes laterally on segments 1-9; prominent black, complex, internal maculation visible in dorsal view on segments 7 and 8. Sterna 7 and 8 often with transverse, pale reddish purple line anteriorly. Genitalia as in Fig. 8.

**Female adult.** Lengths: body 5.6-5.8 mm; forewings 5.0 mm; hindwings 1.0 mm; cerci 6.5-7.0 mm. Body more robust than male, generally pale throughout except for prominent black spiracular markings dorsolaterally on abdomen, black line in cervical area, and faint dark markings laterally on thorax.

**Material examined.** HOLOTYPE: male larva, TEXAS, Austin Co., San Bernard River at I-10, west of Sealy, V-9-1977, W. P. McCafferty, A. V. Provonsha, D. Morihara, in the Purdue Entomological Research Collection. PARATYPES: one male and one female larva, same data and deposition as holotype. Additional material: One female larva and one reared male adult (some parts mounted on slides), TEXAS, Austin Co., San Bernard River at I-10 west of Sealy, V-19-1997, N. A. Wiersma, same deposition as holotype. Three male and two female adults, TEXAS, Williamson Co., Georgetown, San Gabriel River at San Gabriel Park, X-7-1996, N. A. Wiersma,

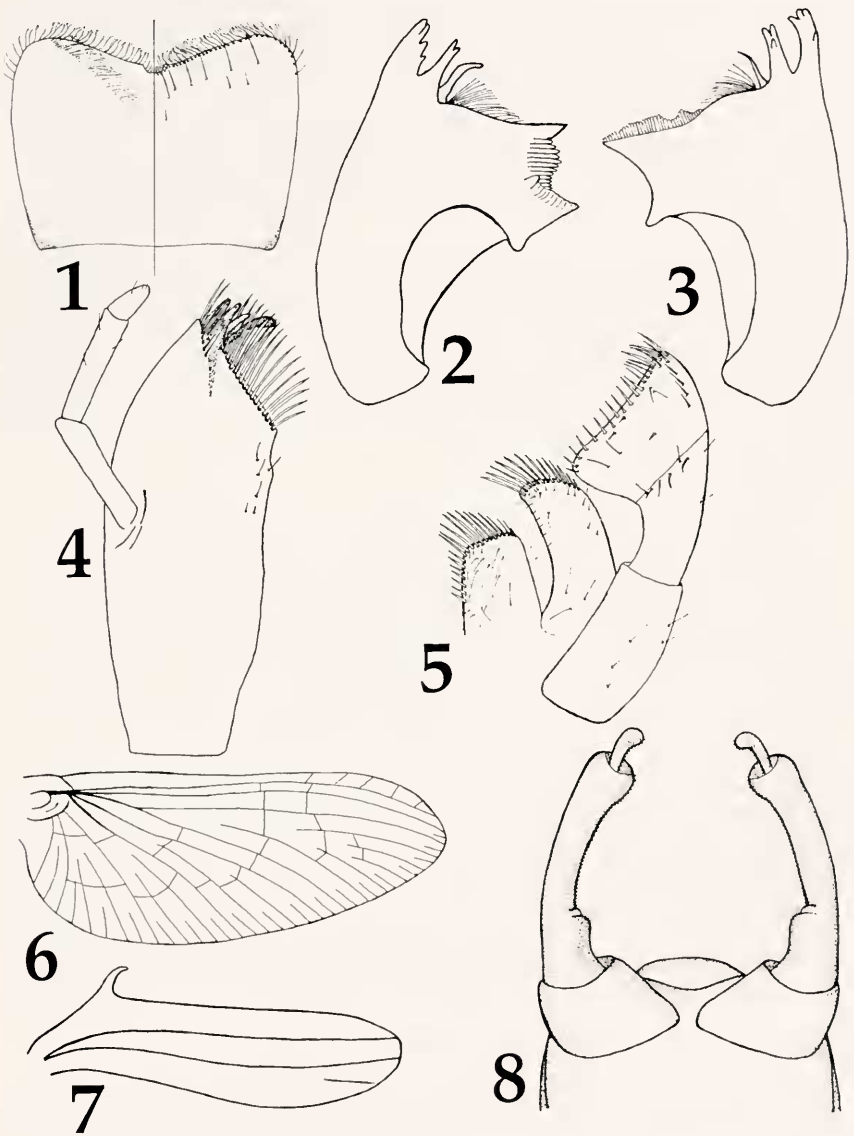
same deposition of holotype, except one male in private collection of NAW. One male adult, TEXAS, Comal Co., Guadalupe River about 11 miles below Canyon Dam, XII-7-1996, N. A. Wiersema, in private collection of NAW.

**Diagnosis.** Larvae of *P. usa* are much larger and more robust than those of *P. morihari*, with mature individuals nearly twice as large. Structurally, *P. morihari* can be further easily distinguished from *P. usa* by the shape of the distal emargination of the labrum (Fig. 1), dorsal labral subapical setae that extend in a row along the entire width of the labrum (Fig. 1), the much more extensive crest of setae on the galealaciniae (Fig. 4), and relatively broader glossae and labial palps segment 3 (Fig. 5) [see comparative figures of *P. usa* in Waltz and McCafferty (1989): Figs. 1, 4, and 5)]. In addition, whereas the paraprocts of *P. morihari* have five or six marginal spines, re-examination of the type material of *P. usa* indicated that they have six or seven. This latter difference is of inconsistent value for diagnosis; however, significant color pattern differences were also revealed from the type material of *P. usa*. Whereas *P. morihari* larvae have a somewhat broad band of pigment anteriorly on abdominal sternum 8, in *P. usa* such a band is prominent on both sterna 8 and 9 and weakly present on sternum 7. In addition, sublateral paired spots that are present on all the abdominal sterna of *P. usa*, but particularly well developed on sterna 7-9, are entirely absent in *P. morihari*.

In the larval key to world species of *Pseudocentropiloides* provided by Waltz and McCafferty (1989), *P. morihari* can most easily be incorporated into it simply by adding another couplet at the end. First, however, the couplet part 3' should be modified to read: "Maxillae [Figs. 31 (Keffermüller and Sowa 1984) and 4 herein] with crest of setae extending basally below crown of galealacinia, subequal to or longer than denticles of galealacinia . . . 4." Couplet 4 should then be added as follows:

4. Labrum (Fig. 1 herein) with relatively short dorsal subapical setae not extending beyond, or much beyond, distal margin of labrum . . . . . *P. morihari*.  
 4'. Labrum [Fig. 1a of Jacob and Glazaczow (1986)] with long dorsal subapical setae extending well beyond distal margin of labrum . . . . . *P. shadini*.

The adults of *P. morihari* and *P. usa* are remarkably similar. Structurally, the only apparently significant differences found involve the wings. In *P. morihari*, the marginal intercalaries of the forewing are relatively long, especially in the posterior half of the wing. Whereas the intercalaries are longer than the respective crossveins connecting longitudinal veins between MA<sub>2</sub> and ICuA<sub>1</sub> in *P. morihari* (Fig. 6), they are shorter by the same comparison in *P. usa* [Fig. 8 of Waltz and McCafferty (1989)]. Also, the hindwings of *P. morihari* (Fig. 7) are slightly broader and have an additional short vein posteriorly. The hindwings of *P. usa* are very narrow and have only two long longitudinal veins [Fig. 9 of Waltz and McCafferty (1989)]. The abdominal segments 1-6 of the male adults are light in color in both species, as is common in many baetid



Figs. 1-8. *Pseudocentropiloides morihari*, n. sp., 1-5. Larva. 1. Labrum (right: dorsal, left: ventral). 2. Left mandible. 3. Right mandible. 4. Left maxilla. 5. Labium (half, dorsal view). 6-8. Male adult. 6. Forewing. 7. Hindwing (enlarged relative to forewing). 8. Genitalia (ventral).

males, but the thorax and abdominal segments 7-10 are slightly more darkly contrasting in *P. usa* than in *P. morihari*. One other possible difference between the males of these species is that in all the material known thus far, the anterior line on abdominal sterna 7 and 8 is broken in the middle in *P. usa*, thus appearing as a pair of lines rather than a single line as in *P. morihari*. Unfortunately, we cannot be sure if any of the adult differences we have reviewed above will be consistent between the species when larger populations are known. All such characteristics have been known to be variable in other adults of certain baetids.

Although the female adult of *P. usa* was not described by Waltz and McCafferty (1989), our examination of the female adult paratype of *P. usa* indicated that the females of *P. morihari* and *P. usa* are very similar, except for the venational differences noted above. In addition, based on the few comparative specimens available, the branching spiracular maculations appear more developed in *P. usa*, and there is a long, horizontal, unbroken, thin, dark line connecting abdominal segments 8 and 9 laterally in *P. usa* that is not present as such in *P. morihari*.

**Remarks.** The San Bernard River where larvae of *P. morihari* have been collected has a shifting sand substrate. Larvae were kicked into a screen or dredged with a D-net from sand and vegetation in relatively shallow water. Adults have been collected at lights at night (as subimagos) from the Guadalupe and San Gabriel Rivers. All of the localities are in the Hill Country of central Texas. Lugo-Ortiz and McCafferty (1995) showed that this area had the highest mayfly diversity in Texas. They also indicated that this area was strongly influenced by eastern North American faunal elements.

Caution should be taken when sorting Texas adults with single marginal intercalaries in the forewings, including *P. morihari*. We have recently reared *Procloeon viridoculare* (Berner) from Texas that as adults have genitalia with a medial protrusion on the forceps that will make them key out to *Pseudocentropiloides* when using the generic key by Edmunds and Waltz (1996). Because there is no doubt that they are *P. viridoculare*, and because we have seen the slight development of such a protrusion on other *Procloeon* in the South and Midwest, there is a potential problem in separating *Procloeon* from *Pseudocentropiloides* when only adults are in hand.

#### ADDITIONAL SPECIES REVISIONS

***Acentrella* sp. 1** Lugo-Ortiz and McCafferty [= *Baetis virilis* (McDunnough)]. The original report of *Acentrella* sp. 1 by Lugo-Ortiz and McCafferty (1995) was based on the male larval stage of *Baetis virilis*. This species lacks hindwings, and because of leg setation was provisionally placed in *Acentrella* at the time. This also represents the first report of *B. virilis* from Texas.

***Acentrella* sp. 2** Lugo-Ortiz and McCafferty [= *Baetis virilis* (McDun-

nough)]. The fact that the female larvae originally referred to as *Acentrella* sp. 2 by Lugo-Ortiz and McCafferty (1995) also is referable to *B. virilis* reflects the fact that the larvae of *B. virilis* are sexually dimorphic (Ide 1937). Differences in the male and female adults of *B. virilis* were first noted by McDunnough (1924).

***Acerpenna* sp. 1** McCafferty and Davis [= *Acerpenna pygmaea* (Hagen)]. McCafferty and Davis (1992) stated that this species was similar to *A. harti* (McDunnough). We now interpret *A. sp. 1* as an adult variant of the relatively widespread species *A. pygmaea*.

***Baetis* sp. 1** McCafferty and Davis [= *Baetis punctiventris* (McDunnough)]. These larvae represent a pale color variant of *B. punctiventris* that lacks the ventral spotting usually typical of the species. It is the most common two-tailed *Baetis* in the Hill country of Texas, where we have additionally seen it from Medina River, Bandera County; Guadalupe River, Comal County; Blanco River, Hays County; Block Creek, Kendall County; and Gorman Creek, San Saba County.

***Camelobaetidius* sp. 1** McCafferty and Davis. This species was originally reported from larvae from the Rio Grande River along the Texas/Mexico border by McCafferty and Davis (1992), and more recently larvae were reported from Colorado by McCafferty et al. (1993). Formal description of a new species has been postponed until more mature specimens are available.

***Centroptilum* sp. 1** McCafferty and Davis [= *Centroptilum triangulifer* (McDunnough)]. McCafferty and Davis (1992) initially noted the similarity of *C. sp. 1* to *C. triangulifer*. Observations of variation in this species since that time indicate that the Texas material falls within the range of variation, and *C. triangulifer* should be added to the list of Texas mayflies.

***Centroptilum* sp. 3** Lugo-Ortiz and McCafferty. The single larva that the report of Lugo-Ortiz and McCafferty (1995) was based on was sent to another co-worker for an opinion as to its identification and has since been lost. Thus, we presume that it will never be resolved. *Procloeon viridoculare* (Berner), which was recently reported from Texas by Wiersema (1998), has been taken from the same locality as *C. sp. 3*, on the South Llano River in Kimble County, but we cannot be sure of any association.

***Procloeon* sp. 1** McCafferty and Davis. Due primarily to the fact that this report was based on female adults, the material still cannot be placed to any nominal species.

***Procloeon* sp. 2** McCafferty and Davis [= *Centroptilum album* McDunnough]. *Centroptilum album* was first reported by Moore (1950) from Texas (San Marcos River); however, that report generally has not been referenced in subsequent inventories of mayflies in Texas. We still cannot verify the accuracy of Moore's report, but must assume it was correct, based on the now confirmed presence of *C. album* in Texas. *Procloeon* sp. 2 was based on larvae that fall within the expected range variation of *C. album*, as had been sug-

gested by McCafferty and Davis (1992). This species has been placed both in *Centroptilum* and *Procloeon* recently; however, it is more consistent with the concept of *Centroptilum* reflected in the key to North American mayfly genera by Edmunds and Waltz (1996).

***Procloeon* sp. 3** McCafferty and Davis. This new but unnamed species was based on highly distinctive larvae from the J. R. Davis private collection taken from Pinto Creek, Kinney County Texas (see McCafferty and Davis 1992). While we were in the process of writing up the formal new description and new name for the McCafferty and Davis species for publication, we learned that other workers had also decided to describe this species independently. Rather than cause an unnecessary synonym in the literature, we are deferring to those others, although to our knowledge a formal description is not in press at this time, nor can we be sure when or if it will be published in the near future.

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